

## **REMARKS**

### A. Background

Claims 1-10, 12, 14-16, and 50-54 were pending in the application at the time of the Office Action. Claims 1-10, 12, 14-16, and 50-54 were rejected as being obvious over cited art. By this response applicant has not canceled, added, or amended any claims. As such, Applicant requests the reconsideration of claims 1-10, 12, 14-16, and 50-54 in light of the following remarks.

### C. Rejections Based on 35 U.S.C. § 103

#### 1. Rejection Based on the Combination of Numai, Funabashi, and Ikeda

Pages 2-13 of the Office Action reject claims 1-7, 9, 10, 14-16 and 50-54 under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 6,501,776 to Numai (“*Numai*”) in view of U.S. Patent No. 6,580,740 to Funabashi (“*Funabashi*”) and further in view of U.S. Patent No. 5,155,737 to Ikeda et al. (“*Ikeda*”). Applicant respectfully traverses this rejection and submits that a prima facie case of obviousness has not been established at least because the allegedly obvious combinations do not include each and every claim limitation recited in the rejected claims. Of the rejected claims, claims 1-3, 5, and 6 are independent claims.

In the prior Response submitted on July 31, 2008, Applicant presented arguments that, among other things, none of the cited references disclose or suggest i) a gain region comprising a diffraction grating with a high coupling coefficient or ii) a gain region and a reflection region that form a cavity for laser oscillation with an extended stop bandwidth, as generally recited in the rejected claims. In the outstanding Office Action, the Examiner attempts to refute the Applicant’s arguments by citing to particular portions of the cited references.

Regarding i), above, the Office Action alleges that “Ikeda ‘737 teaches a gain region coupled with a diffraction grating with a very high coupling coefficient, greater than  $300\text{ cm}^{-1}$  (col. 5, line 67 – col. 6, line 2).” Office Action at p. 2, emphasis added. However, Applicant notes that this is not what is claimed. While *Ikeda* may arguably teach a gain region coupled with a diffraction grating having a high coupling coefficient, *Ikeda* fails to teach a gain region comprising a diffraction grating having a high coupling coefficient. *Ikeda* discloses a gain region 4 physically separated from a diffraction grating 11 by an absorber region 3. See, e.g., Figure 1A. As noted in the section of *Ikeda* cited in the Office Action, diffraction grating 11 may have a high coupling coefficient. See also, col. 5, lines 30-32. However, nowhere in *Ikeda* is it disclosed or suggested that gain region 4 comprises a diffraction grating having a high coupling coefficient. Furthermore, gratings having such high coupling coefficients (i.e., greater than  $300\text{ cm}^{-1}$ ) are not typically used in the gain regions of conventional DFB lasers. For example, in Soda <sup>1</sup>, submitted herewith in a corresponding IDS, a “moderate coupling ( $\kappa L=1.25$ ) was found to be optimum” in a DFB laser. See Abstract. In light of the above discussion, Applicant submits that contrary to the assertion of the Office Action *Ikeda* does not teach or suggest a “gain region [that] comprises a diffraction grating ... [in which] the coupling coefficient of the diffraction grating of said gain region is greater than  $300\text{ cm}^{-1}$ ,” as recited in claims 1, 2, 3, 5, and 6. And as set forth by the Applicant in the July 31<sup>st</sup> Response, none of the other cited references disclose or suggest this limitation either.

Regarding ii) above, the Office Action alleges that “Numai ‘776 teaches forming a cavity for laser oscillation with an extended stop bandwidth (col. 12, lines 13-15).” Office Action at p. 2. The cited section of *Numai* recites: “In the DFB-LD, the oscillation wavelength is either one of

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<sup>1</sup> H. Soda et al., “Stability in Single Longitudinal Mode Operation in GaInAsP/InP Phase-Adjusted DFB Lasers,” IEEE Journal of Quantum Electronics, Vol. QE-23, No.6, pp. 804-814, June 1987.

wavelengths on opposite ends of its stop band when reflectivities at opposite facets of the device are negligibly small and no phase shift section is formed in the diffraction grating 25.” Applicant submits that the cited section of *Numai* only arguably teaches oscillation wavelengths at either end of the stop band, not an extended stop bandwidth.

In the present invention, a cavity is formed with a gain region and a reflection region, the gain region comprising a diffraction grating. In this configuration, the stop bandwidth is determined by the grating in the gain region. Therefore, because the grating has a high coupling coefficient, the reflection bandwidth in the gain region is extended, thereby extending the stop bandwidth in the cavity, due to the reflection region naturally having a much wider reflection bandwidth than the grating in the gain region. Within the extended stop bandwidth, the oscillation wavelength is determined by an optical phase determined by the effective cavity length and length of a propagation region filled with a compensation material. By extending the stop bandwidth, the compensation range for the oscillation wavelength is extended. Such features are not disclosed or even suggested in any of the cited references.

In light of the above, Applicant submits that contrary to the assertion of the Office Action *Numai* does not teach or suggest a gain region and a reflection region or two separate gain regions that “form a cavity for laser oscillation with an extended stop bandwidth,” as recited in claims 1, 2, 3, 5, and 6. And as argued by the Applicant in the July 31<sup>st</sup> Response, none of the other cited references disclose or suggest this limitation either.

In fact, Applicant submits that *Ikeda* actually teaches away from an extended stop bandwidth. In *Ikeda*, a reflector (Bragg reflector 11) having a high coupling coefficient is used. However, the reflector is used with another reflector (Bragg reflector mirror 5) having a low coupling coefficient, so that a cavity is formed therebetween. Because the other reflector (mirror 5) has a low coupling

coefficient, it also has a narrow reflection bandwidth. In this configuration, the oscillation wavelength is determined by the narrow reflection bandwidth of mirror 5, which is shifted by changing the current supplied from electrode 9 to mirror 5. As such, the oscillation bandwidth in the cavity of *Ikeda* is limited by the other reflector (mirror 5), leading to a narrow stop bandwidth, which teaches away from the present invention.

In addition to failing to teach an extended stop bandwidth, the section of *Numai* cited in the Office Action also teaches away from other limitations recited in the rejected claims. Because the cited section of *Numai* teaches that reflectivities at opposite facets of the device are negligibly small, it teaches away from having a grating with a high coupling coefficient in the gain region and high reflectivity in the reflection region as required by the rejected claims.

In light of the above, Applicant submits that the Office Action has failed to establish a prima facie case of obviousness regarding rejected independent claims 1, 2, 3, 5, and 6 at least because the Office Action has not shown that the allegedly obvious combination would include all of the limitations of the rejected claims. Accordingly, Applicant respectfully requests that the obviousness rejection with respect to claims 1, 2, 3, 5, and 6 be withdrawn.

Claims 4, 7, 9, 10, 14-16 and 50-54 variously depend from claims 1, 2, 3, 5, and 6 and thus incorporate the limitations thereof. As such, applicant submits that claims 4, 7, 9, 10, 14-16 and 50-54 are distinguished over the cited art for at least the same reasons as discussed above with regard to claims 1, 2, 3, 5, and 6. Accordingly, Applicant respectfully requests that the obviousness rejection with respect to claims 4, 7, 9, 10, 14-16 and 50-54 also be withdrawn.

## 2. Rejections Based on Further Cited Art

Pages 13-14 of the Office Action reject claims 8 and 12 under 35 USC § 103(a) as being unpatentable over the allegedly obvious *Numai/Funabashi/Ikeda* combination, discussed above, further in view of U.S. Patent No. 4,583,227 to Kirkby (“*Kirkby*”) (claim 8) or U.S. Patent No. 5,719,974 to Kashyap (“*Kashyap*”) (claim 12). *Kirkby* is merely cited for allegedly teaching “an absolute value of a product of a length of said propagating region and a difference between a temperature differential coefficient of the effective refractive index of said gain region and a temperature differential coefficient of the effective refractive index of said propagating region is equal to or greater than  $7.5 \times 10^{-4} \mu\text{m/K}$ .” *Kashyap* is merely cited for allegedly teaching “the length of said propagating region is determined such that a longitudinal mode spacing determined by a sum of an effective length of the diffraction grating of said gain region and a length of said propagating region, is greater than a stop bandwidth of said diffraction grating.” Applicant respectfully traverses these rejections.

Claims 8 and 12 depend from claim 1 and thus incorporate the limitations thereof. As such, Applicant submits that claims 8 and 12 are distinguished over the cited art for at least the same reasons as discussed above with regard to claim 1. Accordingly, Applicant respectfully requests that the obviousness rejection with regard to claim 8 and 12 be withdrawn.

No other objections or rejections are set forth in the Office Action.

## D. Conclusion

Applicant notes that this response does not discuss every reason why the claims of the present application are distinguished over the cited art. Most notably, applicant submits that many if not all of the dependent claims are independently distinguishable over the cited art. Applicant has merely

submitted those arguments which it considers sufficient to clearly distinguish the claims over the cited art.

In view of the foregoing, applicant respectfully requests the Examiner's reconsideration and allowance of claims 1-10, 12, 14-16 and 50-54 as amended and presented herein.

In the event there remains any impediment to allowance of the claims which could be clarified in a telephonic interview, the Examiner is respectfully requested to initiate such an interview with the undersigned.

The Commissioner is hereby authorized to charge payment of any of the following fees that may be applicable to this communication, or credit any overpayment, to Deposit Account No. 23-3178: (1) any filing fees required under 37 CFR § 1.16; (2) any patent application and reexamination processing fees under 37 CFR § 1.17; and/or (3) any post issuance fees under 37 CFR § 1.20. In addition, if any additional extension of time is required, which has not otherwise been requested, please consider this a petition therefor and charge any additional fees that may be required to Deposit Account No. 23-3178.

Dated this 15th day of June 2009.

Respectfully submitted,

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